

**REMARKS**

The Final Office Action mailed October 19, 2006, has been received and reviewed. Claims 1 through 3, 5, 6, 8 through 18, 20, 21, 23 through 34, 36, 37, 39 through 53, and 55 through 59 are currently pending in the application. Claims 1 through 3, 5, 6, 8, 16 through 18, 20, 21, 23 through 28, 30, 32 through 34, 36, 37, 39, 40, 42 through 53, and 55 through 59 stand rejected. Claims 9 through 15 are allowed. In addition, claims 29, 31, and 41 have been objected to as being dependent upon rejected base claims, but otherwise allowable. The indication of allowable subject matter in such claims is noted with appreciation.

Applicants have amended claims 1, 16, 32, and 49, and presented new claims 60 through 62.

In particular, independent claims 1, 16, 32, and 49 have each been amended to reverse amendments previously made to these claims in the Amendment filed July 31, 2006. As the Examiner does not believe the previously added limitation to the particular polymer materials (polyacrylonitrile, polyethyleneoxide, polyethylene glycol, polyvinyl acetate, polyvinyl alcohol, and combinations thereof) rendered these claims patentable, Applicants have amended these claims to again recite that the polymer constituent may be any hydrophilic polymer material, and the scope of these claims is not intended to be limited to the particular polymer materials previously recited in the claims. Applicants have also amended each of independent claims 1, 16, 32, and 49, however, to include additional limitations to further distinguish the present invention over the prior art.

New claims 60, 61, and 62 are substantially identical to previously presented claims 29, 31, and 41, respectively (which were previously indicated to contain allowable subject matter), each rewritten in independent form. As such, Applicants assert that new claims 60 through 62 are allowable.

Applicants respectfully request reconsideration of the application as presented herein.

**35 U.S.C. § 103(a) Obviousness Rejections**

Obviousness Rejection Based on U.S. Patent No. 6,610,780 to Payzant et al. in view of U.S. Publication No. 2002/0032272 to Sievers et al.

Claims 1 through 3 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Payzant et al. (U.S. Patent No. 6,610,780) in view of Sievers et al. (U.S. Publication No. 2002/0032272). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Applicants respectfully assert that Payzant et al. and Sievers et al., when combined and considered as a whole, do not teach or suggest, a nanocomposite material that includes, *inter alia*, a hydrophilic polymer, in which the concentration of the hydrophilic polymer constituent is “configured to impart a predetermined water permeability to the nanocomposite material,” as recited in independent claim 1 as currently amended.

Applicants acknowledge that Payzant et al. teaches a networked polymer/clay alloy (NPC Alloy) that includes clay particles chemically associated with a networked polymer. *Payzant et al.*, column 5, lines 14-21. Payzant et al. teaches that the NPC Alloys may be used in absorbent articles. *Id.*, column 5, lines 24-31.

Sievers et al. teaches a nanocomposite material that includes interpenetrating organic and inorganic networks. *Sievers et al.*, page 3, paragraph [0045]. Sievers et al. teaches that the nanocomposite materials (i.e., the aerogels) can be used as adsorbents, and that the materials have “barrier properties versus water and/or organic solvents.” *Id.*, page 4, paragraphs [0052] – [0053].

Neither Payzant et al. nor Sievers et al. teaches or suggests, however, a hydrophilic polymer constituent having a concentration in a nanocomposite material that is configured to

impart a predetermined water permeability to the nanocomposite material. Payzant et al. merely teaches that “the clay component in the NPC alloy provides a cost effective means to make an NPC alloy while delivering the water absorbing and/or permeability property performance desired for the intended use” (*Payzant et al.*, column 14, lines 17-20), and that “controlling the cross-linking agent to monomer ratio [in the MCX mixture], alone or in combination with the clay to monomer ratio, provides a means for designing the water absorbing and/or permeability property performance desired for the intended use.” (*Id.*, column 15, lines 40-44).

As Payzant et al. and Sievers et al., when considered together, do not teach or suggest all of the limitations of independent claim 1, claim 1 clearly cannot be considered to have been obvious at the time the present invention was made considering Payzant et al. in view of Sievers et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of claim 1 under 35 U.S.C. § 103(a).

Furthermore, the nonobviousness of independent claim 1 precludes a rejection of claims 2 and 3, which depend therefrom, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claims 2 and 3, in addition to the rejection to independent claim 1.

Obviousness Rejection Based on U.S. Publication No. 2002/0032272 to Sievers et al. in view of Sebesta et al., “Composite Ion Exchanger with Ammonium Molybdophosphate and Its Properties”

Claims 1 through 3, 5, 6, and 8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sievers et al. (U.S. Publication No. 2002/0032272) in view of Sebesta et al., “Composite Ion Exchanger with Ammonium Molybdophosphate and Its Properties.” Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicants respectfully assert that Sievers et al. and Sebesta et al., when combined and considered as a whole, do not teach or suggest, *inter alia*, a nanocomposite material that includes a hydrophilic polymer, in which the concentration of the hydrophilic polymer constituent is “configured to impart a predetermined water permeability to the nanocomposite material,” as recited in independent claim 1 as currently amended.

As previously discussed, Sievers et al. teaches a nanocomposite material that includes interpenetrating organic and inorganic networks. *Sievers et al.*, page 3, paragraph [0045]. Sievers et al. teaches that the nanocomposite materials are “suitable as a base material for membranes.” *Sievers et al.*, page 4, paragraph [0054].

Sebesta et al. teaches a composite ion exchanger that includes an organic binding polymer based on polyacrylonitrile (PAN) and ammonium molybdophosphate (AMP) as an active component for adsorption of cesium. Sebesta et al. also suggests using such composite ion exchangers for purification of liquid wastes discharged into the environment.

Neither Sievers et al. nor Sebesta et al., however, teaches or suggests a hydrophilic polymer constituent having a concentration in a nanocomposite material that is configured to impart a predetermined water permeability to the nanocomposite material. Sebesta et al. teaches that “[p]roperties of the binding polymer such as hydrophilicity, porosity and cross-linking may be changed as required” (*Sebesta et al.*, page 16, lines 11-13) but does not teach or suggest configuring a concentration of the binding polymer in a nanocomposite material to impart a predetermined water permeability to the nanocomposite material.

In addition, Applicants respectfully assert that there is no motivation to combine the teachings of Sebesta et al. with the teachings of Sievers et al. Neither Sebesta et al. nor Sievers et al. suggests the desirability of adding AMP to the nanocomposite material taught by Sievers et al. instead of the polyacrylonitrile (PAN) material taught by Sievers et al.

The Examiner has asserted at Page 5 of the Outstanding Office Action that “[i]t would have been obvious to one of ordinary skill in the art to add AMP to the interpenetrating network in Sieves in order to produce a membrane that can effectively remove cesium waste from water and to distribute uniformly so that the cesium uptake will be increased.” Applicants respectfully disagree and assert that the Examiner appears to be using impermissible hindsight and considering Applicants disclosure in the present application. Sievers merely mentions that the materials taught therein may be used as a base materials for membranes. Sebesta et al. teaches that “[t]he shape modification and improvement of granulometric properties of powdered inorganic exchangers may be reached using organic hydrophilic or macroporous polymers and copolymers based on polyacrylonitrile (PAN),” and that the application of this type of binding polymer has several advantages: low price of the polymer, easy preparation of the composite exchanger, possibility of shaping in the form of grains, fibers or membranes.” *Sebesta et al.*,

page 16, lines 3-10. In other words, the teachings of Sebesta et al. are focused on the beneficial properties of PAN-based composite ion exchangers. One of ordinary skill in the art would not have been motivated to replace the PAN material taught by Sebesta et al. with the nanocomposite material taught by Sievers et al. As such, there clearly is no suggestion or motivation to combine or modify the teachings of Sievers et al. and Sebesta et al., as proposed by the Examiner.

As Sievers et al. and Sebesta et al., when considered together, do not teach or suggest all of the limitations of independent claim 1, and because there is no motivation to combine the teachings of Sebesta et al. with the teachings of Sievers et al., claim 1 clearly cannot be considered to have been obvious at the time the present invention was made considering Sievers et al. in view of Sebesta et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of claim 1 under 35 U.S.C. § 103(a).

Furthermore, the nonobviousness of independent claim 1 precludes a rejection of claims 2, 3, 5, 6, and 8, which depend therefrom, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claims 2, 3, 5, 6, and 8, in addition to the rejection to independent claim 1.

Obviousness Rejection Based on Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of U.S. Publication No. 2002/0032272 to Sievers et al.

Claims 1 through 3, 5, 16 through 18, 20, 32 through 34, 36, 49, 52, 53, 55, 57 and 58 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of Sievers et al. (U.S. Publication No. 2002/0032272). Applicants respectfully traverse this rejection, as hereinafter set forth.

Regarding independent claim 1, Applicants respectfully assert that Polson et al. and Sievers et al., when combined and considered as a whole, do not teach or suggest, *inter alia*, a nanocomposite material that includes a hydrophilic polymer, in which the concentration of the hydrophilic polymer constituent is “configured to impart a predetermined water permeability to the nanocomposite material,” as recited in independent claim 1, as currently amended.

Polson et al. teaches “nanocomposites, which combine polymers with ceramics” for use in “subsurface remediation efforts” “through the formation of an *in-situ* permeable reactive barrier (PRB).” The permeable reactive barrier allows for “selective mass transport through the barrier wall to control environmental contaminants.” “The ceramic component of the composite transforms a water-soluble organic polymer into a new material with the same properties as a hydrogel.” “The concept allows water and other benign species to flow through the PRB, while blocking the flow of contaminants of concern.” Polson et al. also mentions the incorporation of “selective cesium capturing agents, such as aminomolybdophosphate (AMP).”

As previously discussed, Sievers et al. teaches a nanocomposite material that includes interpenetrating organic and inorganic networks. *Sievers et al.*, page 3, paragraph [0045].

Neither Polson et al. nor Sievers et al., however, teaches or suggests a hydrophilic polymer constituent having a concentration in a nanocomposite material that is configured to impart a predetermined water permeability to the nanocomposite material.

As Polson et al. and Sievers et al., when considered together, do not teach or suggest all of the limitations of claim 1, this claim clearly cannot be considered to have been obvious at the time the present invention was made considering Polson et al. in view of Sievers et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of independent claim 1 under 35 U.S.C. § 103(a).

Furthermore, the nonobviousness of independent claim 1 precludes a rejection of dependent claims 2 through 3 and 5, which depend therefrom, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claims 2 through 3 and 5, in addition to the rejection to independent claim 1.

Regarding independent claims 16, 32, and 49, Applicants respectfully assert that Polson et al. and Sievers et al., when combined and considered as a whole, do not teach or suggest, *inter alia*, a membrane that includes a nanocomposite material having a hydrophilic polymer constituent, in which the concentration of the hydrophilic polymer constituent is “configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which

the membrane is disposed,” as recited in each of independent claims 16, 32, and 49, as currently amended.

As previously discussed, Polson et al. and Sievers et al. do not teach or suggest a hydrophilic polymer constituent having a concentration in a nanocomposite material that is configured to impart a predetermined water permeability to the nanocomposite material. Furthermore, neither Polson et al. nor Sievers et al. teaches or suggests configuring a concentration of a hydrophilic polymer constituent in a nanocomposite material of a membrane to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed.

As Polson et al. and Sievers et al., when considered together, do not teach or suggest all of the limitations of any one of claims 16, 32, and 49, these claims clearly cannot be considered to have been obvious at the time the present invention was made considering Polson et al. in view of Sievers et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of independent claims 16, 32, and 49 under 35 U.S.C. § 103(a).

Furthermore, the nonobviousness of independent claims 16, 32, and 49 precludes a rejection of dependent claims 17 through 18, 20, 33 through 34, 36, 52, 53, 55, 57, and 58, which each depend from one of claims 16, 32, and 49, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also* MPEP § 2143.03. Therefore, Applicants request that the Examiner withdraw the 35 U.S.C. § 103(a) obviousness rejection to claims 17 through 18, 20, 33 through 34, 36, 52, 53, 55, 57, and 58, in addition to the rejection to independent claims 16, 32, and 49.

Obviousness Rejection Based on Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of U.S. Publication No. 2002/0032272 to Sievers et al. as applied to claims 1-3, 5, 7, 16-18, 20, 22, 31-34, 36, 38, 49, 52-53, 55, 57-58 above, and further in view of U.S. Publication No. 2002/0121470 to Mann et al. or Sebesta et al., “Composite Ion Exchanger with Ammonium Molybdophosphate and Its Properties”

Claims 6, 8, 21, 30, 37, 39, 56, and 59 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of Sievers et al. (U.S. Publication No. 2002/0032272) as

applied to claims 1-3, 5, 7, 16-18, 20, 22, 31-34, 36, 38, 49, 52-53, 55, and 57-58 above, and further in view of Mann et al. (U.S. Publication No. 2002/0121470) or Sebesta et al., “Composite Ion Exchanger with Ammonium Molybdophosphae and Its Properties.” Applicants respectfully traverse this rejection, as hereinafter set forth.

Each of dependent claims 6, 8, 21, 30, 37, 39, 56, and 59 depends from one of independent claims 1, 16, 32, and 49. Applicants respectfully assert that these dependent claims could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering Polson et al. in view of Sievers et al., and further in view of Mann et al. or Sebesta et al., because the references relied upon by the Examiner, when combined, do not teach or suggest, *inter alia*, a nanocomposite material that includes a hydrophilic polymer, in which the concentration of the hydrophilic polymer constituent is “configured to impart a predetermined water permeability to the nanocomposite material,” as recited in independent claim 1, or “configured to impart a water permeability to [a] membrane relative to a hydraulic conductivity of soil in which the membrane is disposed,” as recited in each of independent claims 16, 32, and 49.

As discussed above, Polson et al. and Sievers et al. do not teach or suggest these limitations. Combining the teachings of Mann et al. or Sebesta et al. with the teachings of Polson et al. and Sievers et al. does not satisfy the deficiency.

As previously discussed, Sebesta et al. describes a composite ion exchanger that includes an organic binding polymer based on polyacrylonitrile (PAN) and ammonium molybdophosphate (AMP) as an active component for adsorption of cesium. Sebesta et al. suggests using such composite ion exchanges for purification of liquid wastes discharged into the environment.

Mann et al. teaches beads 302 of a composite medium 300 that includes a matrix material 303 that defines a plurality of pores 302A, in which active components 304 can be distributed. *Mann et al.*, pages 4-5, paragraph [0051]. Mann et al. further teaches that the matrix material 303 may comprise polyacrylonitrile (PAN) and the active component 304 may comprise ammonium molybdophosphate (AMP) (*Id.*, page 5, paragraph [0059]), and that an ion processing system may be used in conjunction with the processing of a fluid stream containing cesium (*Id.*, pages 3-4, paragraph [0041]).

Neither Sievers et al. nor Sebesta et al. teaches or suggests a hydrophilic polymer constituent having a concentration in a nanocomposite material that is configured to impart a



predetermined water permeability to the nanocomposite material. Sebesta et al. teaches that “[p]roperties of the binding polymer such as hydrophilicity, porosity and cross-linking may be changed as required” (*Sebesta et al.*, page 16, lines 11-13) but does not teach or suggest configuring a concentration of the binding polymer in a nanocomposite material to impart a predetermined water permeability to the nanocomposite material. Furthermore, neither Sievers et al. nor Sebesta et al. teaches or suggests a membrane including a nanocomposite material that has a hydrophilic polymer constituent, the concentration of which in the nanocomposite material is configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed.

Applicants additionally assert that there is not motivation to combine the teachings of Sievers et al. and Sebesta et al. for the reasons previously discussed herein.

As Polson et al., considered in view of Sievers et al., and further in view of either Mann et al. or Sebesta et al., does not teach or suggest all the limitations of any one of independent claims 1, 16, 32, and 49, Applicants respectfully assert that dependent claims 6, 8, 21, 30, 37, 39, 56, and 59 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering the references relied upon by the Examiner, and request that the Examiner withdraw the rejection of these dependent claims under 35 U.S.C. § 103(a).

Obviousness Rejection Based on Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of U.S. Publication No. 2002/0032272 to Sievers et al. as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of EPA/600/R-98/125 “Permeable Reactive Barrier Technologies for Contaminant Remediation”

Claims 24 through 28, 44 through 48, and 51 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of Sievers et al. (U.S. Publication No. 2002/0032272) as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of EPA/600/R-98/125 “Permeable Reactive Barrier Technologies for Contaminant Remediation.” Applicants respectfully traverse this rejection, as hereinafter set forth. Each of claims 24 through 28 depends from claim 16, each of claims 44 through 48 depends from claim 32, and claim 51 depends from claim 49.

Applicants respectfully assert that claims 24 through 28, 44 through 48, and 51 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering Polson et al. in view of Sievers et al. and EPA because the references relied upon by the Examiner, when combined, do not teach or suggest, *inter alia*, a membrane that includes a nanocomposite material having a hydrophilic polymer constituent, in which the concentration of the hydrophilic polymer constituent is “configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed,” as recited in each of independent claims 16, 32, and 49, as currently amended. As discussed above, Polson et al. and Sievers et al. do not teach or suggest these limitations. Combining the teachings of EPA with the teachings of Polson et al. and Sievers et al. does not satisfy the deficiency.

EPA describes the use of permeable reactive barriers for treating contaminated water. EPA teaches providing a membrane in an excavated trench within a portion of the water table in the ground. *See EPA*, pages 28-29. EPA further describes substantially impermeable walls positioned and located within the ground to direct flow of groundwater toward the membrane. The walls are disposed at an angle greater than zero degrees in relation to the membrane, and suggest that the walls may be disposed in a portion of the water table. *See EPA*, FIG. 1 at page 1, and FIG. 8b at page 28.

EPA does not teach or suggest, however, a membrane including a nanocomposite material that has a hydrophilic polymer constituent, the concentration of which in the nanocomposite material is configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed. As Polson et al., Sievers et al., and EPA, when combined, do not teach or suggest all the limitations of any of independent claims 16, 32, and 49, Applicants respectfully assert that dependent claims 24 through 28, 44 through 48, and 51 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering the references relied upon by the Examiner, and request that the Examiner withdraw the rejection of these dependent claims under 35 U.S.C. § 103(a).

Obviousness Rejection Based on Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of U.S. Publication No.

2002/0032272 to Sievers et al. as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of U.S. Publication No. 2001/0033772 to Gilmore et al.

Claims 23, 40 and 50 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of Sievers et al. (U.S. Publication No. 2002/0032272) as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of Gilmore et al. (U.S. Publication No. 2001/0033772). Applicants respectfully traverse this rejection, as hereinafter set forth.

Claim 23 depends directly from claim 16 and includes the elements and limitations recited therein, claim 40 depends directly from claim 32 and includes the elements and limitations recited therein, and claim 50 depends directly from claim 49 and includes the elements and limitations recited therein.

Applicants respectfully assert that claims 23, 40, and 50 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering the cited prior art references because, when combined, the references relied upon by the Examiner do not teach or suggest, *inter alia*, a membrane that includes a nanocomposite material having a hydrophilic polymer constituent, in which the concentration of the hydrophilic polymer constituent is “configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed,” as recited in each of independent claims 16, 32, and 49, as currently amended. As discussed above, Polson et al. and Sievers et al. do not teach or suggest these limitations. Combining the teachings of Gilmore et al. with the teachings of Polson et al. and Sievers et al. does not satisfy the deficiency.

Gilmore et al. describes forming a reactive barrier in a vadose region of the ground. The reactive barrier is formed by modifying the soil or its properties. *Gilmore et al.*, page 2, paragraphs [0019], [0023]; Figure 1.

Gilmore et al. does not teach or suggest, however, a membrane including a nanocomposite material that has a hydrophilic polymer constituent, the concentration of which in the nanocomposite material is configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed. As Polson et al., Sievers et al., and Gilmore et al., when combined, do not teach or suggest each of the limitations of any one of dependent claims 23, 40, and 50, these claims could not have been

obvious to a person of ordinary skill in the art at the time the invention was made considering Polson et al., Sievers et al., and Gilmore et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of dependent claims 23, 40, and 50 under 35 U.S.C. § 103(a).

Obviousness Rejection Based on Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of U.S. Publication No. 2002/0032272 to Sievers et al. as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of U.S. Patent No. 5,728,302 to Conner et al.

Claims 42 and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Polson et al., “Synthesis, Characterization, and Ion Sequestration of Novel Nanocomposite Materials” in view of Sievers et al. (U.S. Publication No. 2002/0032272) as applied to claims 1-3, 5, 16-18, 20, 32-34, 36, 49, 52-53, 55, 57-58 above, and further in view of Conner et al. (U.S. Patent No. 5,728,302). Applicants respectfully traverse this rejection, as hereinafter set forth.

Each of claims 42 and 43 depends either directly or indirectly from claim 32 and, as a result, each includes the elements and limitations recited in independent claim 32.

Applicants respectfully assert that claims 42 and 43 could not have been obvious to a person of ordinary skill in the art at the time the inventions were made considering the references relied upon by the Examiner because, when combined, the references do not teach or suggest, *inter alia*, a membrane that includes a nanocomposite material having a hydrophilic polymer constituent, in which the concentration of the hydrophilic polymer constituent is “configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed,” as recited in independent claim 32 as currently amended. As discussed above, Polson et al. and Sievers et al. do not teach or suggest these limitations. Combining the teachings of Conner et al. with the teachings of Polson et al. and Sievers et al. does not satisfy the deficiency.

Conner et al. describes introducing an ion exchange resin into a reservoir matrix to act as an “in-situ filter for dissolved radionuclides presenting the reservoir (or aquifer) fluids. *Conner et al.*, column 3, lines 20-25. The fine resin “is directly introduced into the reservoir as a solid phase component of a solid-liquid slurry using high-pressure injection techniques. *Conner et al.*, column 3, lines 25-27.

Conner et al. does not, however, teach or suggest a membrane including a nanocomposite material that has a hydrophilic polymer constituent, the concentration of which in the nanocomposite material is configured to impart a water permeability to the membrane relative to a hydraulic conductivity of soil in which the membrane is disposed. As Polson et al., Sievers et al., and Conner et al., when combined, do not teach or suggest each of the limitations recited in any one of dependent claims 42 and 43, these claims could not have been obvious to a person of ordinary skill in the art at the time the inventions were made considering Polson et al., Sievers et al., and Conner et al. Therefore, Applicants respectfully request that the Examiner withdraw the rejection of dependent claims 42 and 43 under 35 U.S.C. § 103(a).

Regarding dependent claim 42, Applicants additionally assert that none of the prior art references relied upon by the Examiner teach or suggest forming a membrane by “injecting a slurry into the ground, the slurry comprising a plurality of discrete particles of [a] nanocomposite material dispersed in a liquid,” as recited in dependent claim 42 as currently amended. Therefore, Applicants respectfully assert that dependent claim 42 could not have been obvious to a person of ordinary skill in the art at the time the invention was made considering the references relied upon by the Examiner, and request that the Examiner withdraw the rejection of dependent claim 42 under 35 U.S.C. § 103(a) for this additional reason.

### **Objections to Claims 29, 31 and 41/Allowable Subject Matter**

Claims 29, 31, and 41 stand objected to as being dependent upon rejected base claims, but are indicated to contain allowable subject matter and would be allowable if placed in appropriate independent form. Applicants note the indication of allowable subject matter with appreciation. Applicants respectfully assert, however, that independent claims 16 and 32 (from one of which each of claims 29, 31, and 41 depends), as amended herein, are allowable over the cited prior art references. Therefore, applicants request that the objections to claims 29, 31, and 41 be withdrawn.

**CONCLUSION**

Claims 1 through 3, 5, 6, 8 through 18, 20, 21, 23 through 34, 36, 37, 39 through 53, and 55 through 62 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

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